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July 1956 ARS-33-28

United States Department of Agriculture
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ATTEMPTS TO CONTROL CERTAIN COTTON, CORN, AND VEGETABLE-CROP INSECTS WITH LIGHT TRAPS

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Light traps were found ineffective in controlling the pink bollworm where eight traps were used at widely separated points with only one trap per field (Pfrimmer et al. 1955). In 1955 an opportunity to observe the effects of a large number of light traps used against this insect, as well as other insects on cotton, corn, and a number of vegetable crops, was afforded through cooperation with growers who operated the traps at Batesville, Tex. An experiment was also conducted at Brownsville, Tex., with a light trap operated for pink bollworm control in a large cage.

Field Experiment

In the large-scale experiment at Batesville, growers operated 142 light traps on five adjacent farms comprising a block of approximately 3,000 acres. This acreage, called the trap area, was compared with check fields outside of the area. The traps were of the electric-grid type with two 15-watt black-light fluorescent lamps (fig. 1). As can be noted from the photograph, the grids sometimes became clogged with dead insects, thereby tending to lose effectiveness through shorting. Changes in design would be needed to assure destruction of insects attracted. Insects collected in four "indicator" traps of a different type were examined to determine the seasonal abundance of the more important species. Counts were made in representative fields of the trap and check areas. Crops observed were corn, cotton, and a number of vegetables.

1/ Conducted in cooperation with the Texas Agricultural Experiment Station and the Agricultural Engineering Research Branch.

2/ Others helping to obtain the records were Ben H. Richardson of the Texas Agricultural Experiment Station and L. M. Carter and Harold Sattler of the Agricultural Engineering Research Branch.

Corn

A rather large acreage of field corn was grown for producing hybrid seed. A small acreage of sweet corn was also grown, but was eliminated from the infestation counts since it had been treated with insecticides. Infestation records on the corn earworm (Heliothis zea (Boddie)) were obtained from fields where no insecticides were used. A 100-ear sample was examined from each field, and eight fields were sampled in each area. The counts included the fall armyworm (Laphygma frugiperda (J. E. Smith)).

The light traps did not give any control of the corn earworm. The infested ears averaged 99.5 percent in the light-trap area and 99.3 percent in the check. The respective average numbers of worms per 100 ears were 255 and 237.

Cotton

Cotton was the major crop grown during the summer and produced about two bales per acre in both the trap and check areas. Growers applied insecticides about equally in both areas. The number of applications in the different fields in the trap area ranged from 7 to 10 and averaged 8.4, and in the check fields ranged from 6 to 11 and averaged 8.8. Bollworm and pink bollworm infestation records were obtained from five fields in each area, and in the trap area the counts were made at points 100, 450, and 800 feet from each of nine traps. These points were marked by stakes permanently set up for guidance in the sampling procedures. Boll weevils and other insects were of minor importance.

Bollworm.--The insecticides used were applied primarily for control of the bollworm (Heliothis zea (Boddie)). Weekly records from the middle of June through the third week of August (table 1) show a heavy infestation as indicated by abundance of eggs, but indicate that insecticides reduced the larval population so as to prevent appreciable crop damage. The light traps appeared to be of no benefit. Bollworm eggs were most abundant during the week ending July 23, when the number per 100 plant terminals averaged 95 in the trap area and 78 in the check. The respective seasonal averages were 30.6 and 29.6. The weekly average number of young larvae per 100 plant terminals never rose above 2 in the trap area or above 1.2 in the check, and the seasonal averages 0.64 and 0.52.

There was no significant difference in the seasonal average infestations at various distances from traps. At distances of 100, 450, and 800 feet the numbers of eggs per 100 plant terminals averaged 26, 31, and 34, and the number of young larvae 0.5, 0.7, and 0.8.

Pink Bollworm.--Insecticides used for bollworm control were also effective against the pink bollworm except in one check field treated with endrin. Infestation counts were made biweekly. The records were negative until the last of July, and the late buildup in infestation was negligible from the standpoint of crop yield. As green bolls decreased in number, becoming scarce at the end of the season, the percentage infested increased rapidly, but the few damaged bolls caused no appreciable reduction in yield.

The infestation records are shown in table 2. Although the percentage of bolls infested was slightly lower in the trap area, this difference cannot be attributed to control by light traps. Scarcity of green bolls was the major cause of the very rapid increase in percentage of bolls infested in the last two counts. Consequently, variation in number of bolls present resulted in some difference in infestation between fields. Fields 4 and 5 in the light-trap area had more green bolls, and although the boll infestation did not reach 100 percent, they had higher larval populations per acre than some of the other fields. In field 5 of the check area the lack of any insecticide effective against the pink bollworm and the fact that green bolls became scarce exceptionally early caused a rapid and early increase in the percentage of bolls infested.

The pink bollworm infestation did not vary appreciably with the distance from the traps. The seasonal average percentages of bolls infested at 100, 450, and 800 feet from traps were 33.4, 30.7, and 33.6, respectively.

These field observations confirm the cage-experiment evidence that the light traps were of no appreciable benefit in pink bollworm control.

Vegetable Crops

Personnel stationed in the area during the summer left at the end of the cotton-growing season. Surveys on vegetable crops grown during the fall and winter months were made periodically from October through December by personnel making brief visits from Brownsville. The crops observed during this period consisted of broccoli, brussels sprouts, cabbage, cauliflower, and lettuce. Insecticide applications were made for control of disease-carrier leafhoppers as well as the Lepidoptera that might be attracted to light traps. The insecticides were used about equally in the trap and check areas, the number of applications ranging from 3 to 6. The cabbage looper (*Trichoplusia ni* (Hbn.)) was the major pest observed and the only one for which counts were made. Six or more fields were inspected in each area.

From observations made on October 7 it was apparent that the light traps were not controlling the cabbage looper, although infestation records were not obtained in check fields at that time. It was learned that this insect had been destructive in the light-trap area for the past month and some fields had received four insecticide applications. In one field of young lettuce 18 eggs were found on 25 plants.

Three later surveys, made on October 25, November 17, and December 20, showed a decrease in the infestation, with no benefit from the light traps. Very little insecticide was used during this period. In each of the three surveys the largest numbers of larvae and eggs found on a single 100-leaf sample were in the light-trap area. The respective average numbers in the trap and check areas were 2.8 and 1.8 in the first, 2.3 and 2.8 in the second, and 3.0 and 1.4 in the last survey.

Other insects were of minor importance. In the October 7 survey a light infestation of the corn earworm was noted on all crops, and a few small flea beetles were causing slight damage.

Indicator Traps

The insects from four traps were examined to determine the seasonal abundance of certain species. These traps contained single lamps identical to those in the insect-control experiment, but instead of the electric grid they were equipped with baffles and a killing can for collecting the insects (fig. 2). Three of the traps were in the trap area, replacing three of the grid type, and the fourth was located in the check area. It was thought that probably the three in the trap area, competing with other traps, would catch fewer insects than the one in the check area. The numbers caught were recorded for six species, a mixed group of cutworms, and a group of *Protoparce* spp. (hornworms). The sex ratios of *Heliothis zea*, *Protoparce* spp., and cutworms were determined from a catch in all traps at least once each week.

The belief that a greater number of insects would be caught per trap in the check area than in the trap area did not prove to be true. The numbers of bollworm moths taken during the season from the trap area were 22,631, 17,043, and 33,709 compared with 16,081 from the check area. The numbers of pink bollworm moths were 4,730, 1,624, and 24,978 from the trap area and 1,096 for the check.

The numbers of specimens of the various species caught in the four traps are tabulated for biweekly periods in table 3. The number of bollworm moths increased until a peak was reached the last of July, which was in direct correlation with the infestation records obtained. Pink bollworm moths did not appear in the traps until the last part of July and were not caught in large numbers until green bolls became scarce. Female bollworms outnumbered the males, but the reverse was true of the cutworms and hornworms.

Cage Test With Pink Bollworm

Cotton infested with the pink bollworm (Pectinophora gossypiella (Saund.)) was grown in a screened cage partitioned into two sections 40 x 60 feet each. An insect-collecting trap with four 15-watt black-light fluorescent lamps was operated in one section, and the other section was used as a check. Examination of early blooms immediately before operation of the trap was begun showed a low initial infestation from winter carry-over. Therefore, it was deemed advisable to introduce additional pink bollworm moths into the cage. A total of 53 male and 73 female moths were released in each section on April 19-20. The light trap was operated continuously from April 19 until the end of the experiment on July 15.

All the trap collections were examined daily and the numbers of pink bollworm moths recorded. After the first bolls became approximately 30 days old, 50-boll samples from the respective sections were examined about once a week. Green bolls became scarce during the last 2 weeks of the experiment.

The trap-collection and infestation records are shown in table 4. There was practically no difference in rate of buildup between the light-trap and check sections of the cage as the season advanced, and the percent of infested bolls reached 100 in both sections during the same week. This lack of any material reduction in infestation despite the large number of moths caught indicates that moths deposit eggs before being trapped.

Summary

Light traps of the electric-grid type with two 15-watt black-light fluorescent lamps were used by growers for insect control on cotton, corn, broccoli, brussels sprouts, cabbage, and lettuce at Batesville, Tex., in 1955. There were 142 traps operated on five adjacent farms comprising approximately 3,000 acres. Infestation counts in representative fields of the trap area and in the check fields outside of the area showed that these traps were of no benefit in control of the bollworm (Heliothis zea (Boddie)), the pink bollworm (Pectinophora gossypiella (Saund)), and the cabbage looper (Trichoplusia ni (Hbn.)). Other insects were of minor importance. Counts of bollworms and pink bollworms 100, 450, and 800 feet from traps showed that the infestations did not vary appreciably with the distance from the traps.

At Brownsville, Tex., cotton infested with the pink bollworm was grown in a screened cage partitioned into two sections 40 x 60 feet each, and an insect-collecting type trap with four 15-watt black-light lamps was operated in one section while the other was used as a check. Although the trap caught a large number of pink bollworm moths during

a period of 8 weeks, there was no appreciable difference in rate of buildup in infestation between light-trap and check sections. The percent of infested bolls reached 100 in both sections within the same week. This lack of reduction in infestation of the trap section, despite the high moth catch, indicates that moths deposit eggs before being trapped.

Literature Cited

(1) Pfrimmer, Theodore R., Lukefahr, M. J., and Hollingsworth, J. P. 1955. Experiments with light traps for control of the pink bollworm. U. S. Dept. Agr. ARS-33 6.

Table 1.--Bollworm infestation in light-trap and check areas, Batesville, Tex., 1955. Numbers per 100 plant terminals.

Week ending	Eggs		Larvae	
	Light-trap area	Check area	Light-trap area	Check area
June 18	2	5	0.2	0.8
25	7	5	.5	.2
July 2	30	27	.8	.4
9	51	45	2.0	0
16	37	46	1.2	1.2
23	95	78	1.2	1.2
30	31	46	.9	1.0
Aug. 6	32	27	.9	1.2
13	7	4	0	.2
20	14	13	0	0
Average	30.6	29.6	0.64	0.52

Table 2.--Percent of bolls infested with pink bollworms in light-trap and check areas, Batesville, Tex., 1955

2 weeks ending	Field 1	Field 2	Field 3	Field 4	Field 5
			Light-trap area		
July 29	3	0	0	1	0
Aug. 12	28	15	3	2	2
19	55	54	35	12	13
Sept. 7	100	100	100	80	70
			Check area		
July 29	2	3	2	0	44
Aug. 12	16	19	20	13	87
19	86	96	73	58	100
Sept. 7	99	100	100	-	-

Table 3.--Moths captured in four light traps in biweekly periods from April 22 to September 7, 1955, Batesville, Tex.

Species	May 6	May 20	June 3	June 17	July 1	July 15	July 29	Aug. 12	Aug. 26	Sept. 7
					Number of specimens					
Heliothis zea (Boddie)	225	383	3175	5679	14033	19736	23297	7540	6689	8707
Pectinophora gossypiella (Saund.)	0	0	0	0	0	0	836	1549	16346	13697
Cutworms (mixed species)	208	564	1010	1111	1243	2825	1008	1153	1062	569 1/
Protoparce spp.	6	89	223	128	58	82	133	70	477	85 1/
Loxostege similalis (Guen.)	--	10558	7650	11682	17827	34552	20776	87745	51206	27812 1/
Laphygma frugiperda (J. E. Smith)	--	--	60	11	2584	8288	4000	14734	14089	10818 1/
Pseudaletia unipuncta (Haw.)	--	--	19 1/	104	759	1586	623	406	1376	261 1/
Prodenia ornithogalli Guen.	--	--	8	439	2636	635	272	410	816	852 1/
					Percent of females					
Heliothis zea (Boddie)	--	41.3	45.1	45.5	52.6	56.6	56.6	57.8	51.3	34.3
Cutworms (mixed species)	--	53.2	60.1	47.7	48.7	38.5	58.6	43.4	38.0	20.7
Protoparce spp.	--	39.2	43.9	38.2	34.5	24.0	19.6	27.1	19.7	32.9

1/ 1-week catch.

Table 4.--Experiment with light trap for pink bollworm control in large cage, Brownsville, Tex., 1955.

Week ending	Number of moths caught in section with trap		Percent of bolls infested	
	Males	Females	Section with trap	Check
April 22	9	11	--	--
27	0	1	--	--
May 6	4	6	--	--
12	7	5	--	--
19	3	4	0	0
27	36	32	--	--
June 3	52	41	4	10
10	39	20	46	68
17	79	32	68	68
24	322	213	68	80
July 1	1407	1037	83	86
8	1473	981	86	98
15	778	536	100	100

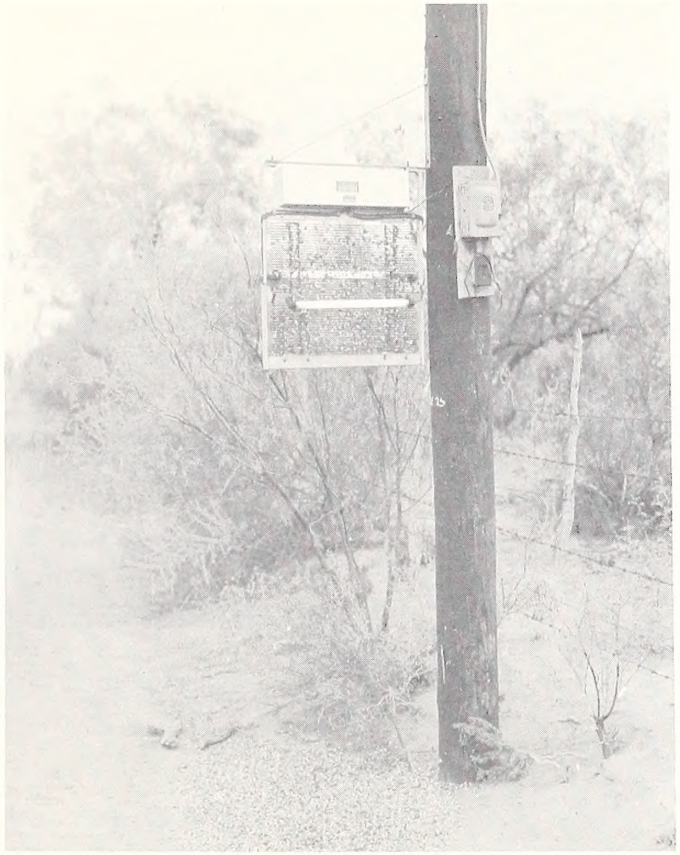

Figure 1.--Electric grid trap with two 15-watt black-light fluorescent lamps.

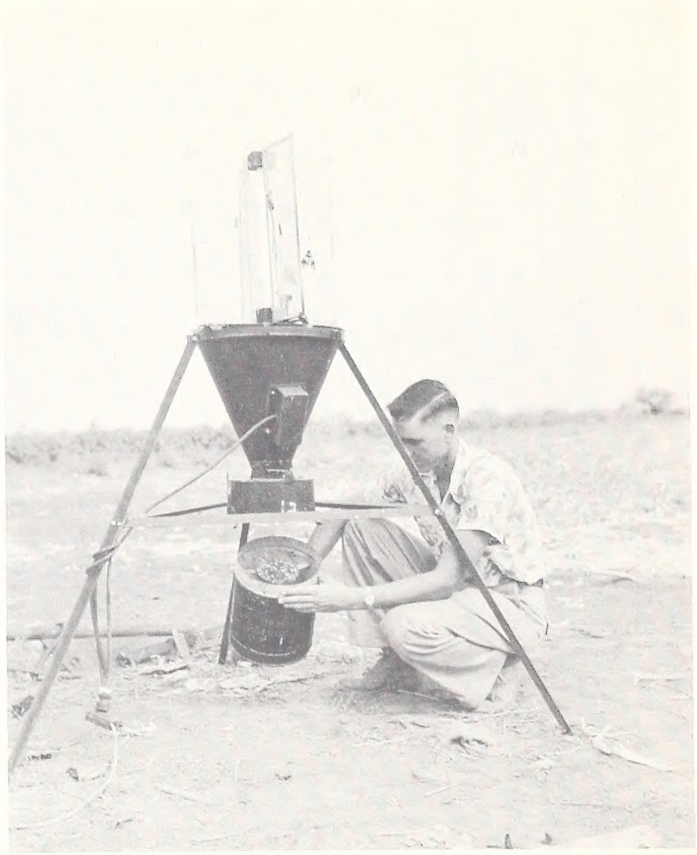

Figure 2.--Texas-style indicator trap with a single 15-watt black-light fluorescent lamp, designed to exclude rain from can containing calcium cyanide flakes at bottom of funnel.